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94 S.Ct. 576, 38 L.Ed.2d 472 (1973). Accordingly, the absence of even one element and its equivalent function of a claimed invention places the accused device outside the coverage of the claims.

[6] Having previously determined that clause (F) is an essential part of claim 1, and that plaintiff has failed to show that the accused devices have a probe of reduced cross-sectional area, it must be concluded that plaintiff has failed to establish infringement of not only independent claim 1, but also of dependent claims 2-10.

CONCLUSION OF LAW

The court concludes as a matter of law that claims 1-10 of the patent in suit are not infringed by defendant. Plaintiff, accordingly, is not entitled to recover and its petition is therefore dismissed.



Application of Robert N. JOHNSON and
Alford G. Farnham.

Patent Appeal No. 76-643.

United States Court of Customs
and Patent Appeals.

June 16, 1977.

The Patent and Trademark Office Board of Appeals affirmed rejection of various claims in application, Serial No. 230,091, for "Polyarylene Polyethers," and appeal was taken. The Court of Customs and Patent Appeals, Markey, C. J., held that: (1) subject matter embraced by certain claims was definite and claims set out and circumscribed particular area with reasonable degree of precision and particularity; (2) claims were improperly rejected as broader than the enabling disclosure; (3) fact that applicant deleted certain compounds from protection sought and claimed

less than full scope of disclosure did not render application insufficient under statute relating to specification.

Reversed.

Lane, J., dissented in part and filed opinion.

1. Patents \Leftarrow 101(6)

Under statute providing that specification shall conclude with one or more claims particularly pointing out and distinctly claiming subject matter which the applicant regards as his invention, inquiry is whether claims do, in fact, set out and circumscribe particular area with reasonable degree of precision and particularity; definiteness of language employed must be analyzed, not in a vacuum, but always in light of the teachings of the prior art and of the particular application disclosure as it would be interpreted by one possessing the ordinary level of skill in the pertinent art. 35 U.S.C.A. § 112.

2. Patents \Leftarrow 99

For purpose of statute relating to specification, undue breadth is not "indefiniteness." 35 U.S.C.A. § 112.

See publication Words and Phrases
for other judicial constructions and
definitions.

3. Patents \Leftarrow 101(4)

Claim language must be read in light of the specification as it would be interpreted by one of ordinary skill in the art. 35 U.S.C.A. § 112.

4. Patents \Leftarrow 101(5)

Subject matter embraced by claims relating to polyarylene polyether polymers set out and circumscribed particular area with reasonable degree of precision and particularity, and thus rejection of claims under statute requiring specification to conclude with one or more claims particularly pointing out and distinctly claiming subject matter which applicant regarded as his invention was unwarranted. 35 U.S.C.A. § 112.

APPENDIX

B

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5. Patents \Leftarrow 99, 101(1)

It is the function of the specification, not the claims, to set forth the practical limits of operation of an invention; one does not look to the claims to find out how to practice the invention they define, but to the specifications. 35 U.S.C.A. § 112.

6. Patents \Leftarrow 101(3)

Specification as a whole must be considered in determining whether scope of enablement provided by specification is commensurate with scope of the claims. 35 U.S.C.A. § 112.

7. Patents \Leftarrow 101(5)

To provide effective incentives, claims must adequately protect inventors; to demand that the first to disclose shall limit his claims to what he has found will work or to materials which meet the guidelines specified for "preferred" materials in a process would not serve constitutional purpose of promoting the progress in the useful arts. 35 U.S.C.A. § 112.

8. Patents \Leftarrow 99

For purpose of claims relating to polyarylene polyether polymers, specification satisfied statutory requirements that specification contain concise written description of invention so as to enable any person skilled in the art to make and use the invention and that specification set forth best mode contemplated by inventor of carrying out his invention. 35 U.S.C.A. § 112.

9. Patents \Leftarrow 109

Fact that applicants excluded from original claims two species specifically disclosed in 1963 application did not render disclosure insufficient, under statute relating to specification, for "limited genus" claim where claim was otherwise entitled to benefit of 1963 filing date and where applicants had merely narrowed their claims to avoid having them read on a lost interference. 35 U.S.C.A. § 112.

Claims 10-54 and 65-67 stand allowed. A petition for reconsideration was denied by the Board.

The O-linkages in the general formula are not other linkages.

10. Patents \Leftarrow 98

It is for the inventor to decide what bounds of protection he will seek. 35 U.S.C.A. § 112.

Robert C. Brown, New York City, Aldo J. Cozzi, Union City, N. J., attorneys of record, for appellants; James C. Arvantes, Arlington, Va., of counsel.

Joseph F. Nakamura, Washington, D. C., for the Commissioner of Patents; Henry W. Tarring, II, Washington, D. C., of counsel.

Before MARKEY, Chief Judge, and RICH, BALDWIN, LANE and MILLER, Judges.

MARKEY, Chief Judge.

This appeal is from the decision of the Patent and Trademark Office (PTO) Board of Appeals affirming the rejection under 35 U.S.C. §§ 102 or 103 (the rejection also raises a written description issue under 35 U.S.C. § 112, first paragraph) of claims 1-9, 64, and 68-70 and the rejection under 35 U.S.C. § 112, first paragraph (enablement) and second paragraph (indefiniteness), of claims 64 and 68-72 in appellants' application No. 230,091 filed February 28, 1972 (the 1972 application) for "Polyarylene Polyethers."¹ The 1972 application is a continuation-in-part of three earlier applications, the earliest being application No. 295,519 filed July 16, 1963 (the 1963 application). We reverse.

The Invention

The invention is in the field of polymer chemistry and more specifically relates to linear thermoplastic polyarylene polyether polymers composed of recurring units having the general formula —O—E—O—E'— where O represents an oxygen atom,² E represents the residuum of a dihydric phenol³ compound, and E' represents the resid-

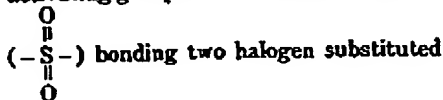
3. A dihydric phenol is a type of aromatic organic compound in which two hydroxy (-OH) groups are attached directly to a benzene ring.

uum of a benzenoid compound having one or more inert electron withdrawing groups⁴ in the ortho⁵ or para⁶ positions to the valence bonds and where both E and E' are bonded to the ether oxygens through aromatic carbon atoms.

Appellants describe a method of synthesizing these polymers by reacting a double alkali metal salt of a dihydric phenol with a dihalobenzenoid compound in the presence of certain solvents under substantially anhydrous reaction conditions.

The 1972 application includes the following disclosure with respect to the electron withdrawing group found in E' and in the E' precursor compound, that is, in the compound which is the predecessor of E' in the above general formula (we have designated paragraphs [A] and [B] and have added emphasis thereto):

Any electron withdrawing group can be employed as the activator group in these compounds. It should be, of course, inert to the reaction, but otherwise its structure is not critical. Preferred are the strong activating groups such as the sulfone group



benzenoid nuclei as in the 4,4'-dichlorodiphenyl sulfone and 4,4'-difluorodiphenyl sulfone, although such other strong withdrawing groups hereinafter mentioned can also be used with equal ease.

The more powerful of the electron withdrawing groups give the fastest reactions and hence are preferred. It is further preferred that the ring contain no

4. An electron withdrawing group is a substituent which withdraws electrons from the aromatic ring to which it is attached.
5. An aromatic ring bearing substituents on adjacent carbon atoms is called ortho substituted.
6. An aromatic ring bearing substituents on opposite carbon atoms is called para substituted.
7. Appellants' brief specifically refers to one of the publications cited (*Chem. Rev.*, 53, 222 [1953]) and states that its author (Jaffe) defines

electron supplying groups on the same benzenoid nucleus as the halogen; however, the presence of other groups on the nucleus or in the residuum of the compound can be tolerated. Preferably, all of the substituents on the benzenoid nucleus are either hydrogen (zero electron withdrawing), or other groups having a positive sigma* value, as set forth in J.F. Bunnett in *Chem. Rev.* 49 273 (1951) and *Quart. Rev.*, 12, 1 (1958). See also Taft, *Steric Effects in Organic Chemistry*, John Wiley & Sons (1956), chapter 13; *Chem. Rev.*, 53, 222; *JACS*, 74, 3120; and *JACS*, 75, 4231.⁷

The electron withdrawing group of the dihalobenzenoid compound can function either through the resonance of the aromatic ring, as indicated by those groups having a high sigma* value, i.e., above about +0.7 or by induction as in perfluoro compounds and like electron sinks.

[A]

Preferably the activating group should have a high sigma value, preferably above 1.0, although sufficient activity to promote the reaction is evidenced in those groups having a sigma value above 0.7, although the reaction rate with such a low powered electron withdrawing group may be somewhat low.*

The activating group can be basically either of two types:

(a) monovalent groups that activate one or more halogens on the same ring as a nitro group, phenylsulfone, or alkylsulfone, cyano, trifluoromethyl, nitroso, and hetero nitrogen as in pyridine.

the sigma* value as a "special substituent constant" for the "Hammett equation" which is an empirically derived formula intended to show a general quantitative relation between the nature of a given substituent and the reactivity of a side chain. Thus, sigma* values are based on experimental data and they measure the "activation energy" of a given substituent (electron withdrawing group).

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(b) divalent group [sic] which can activate displacement of halogens on two different

rings, such as the sulfone group $\begin{array}{c} \text{O} \\ \parallel \\ -\text{S}- \\ \parallel \\ \text{O} \end{array}$; the

carbonyl group $\begin{array}{c} \text{O} \\ \parallel \\ -\text{C}- \end{array}$; the vinyl group $\begin{array}{c} \text{O} \\ \parallel \\ -\text{C}=\text{C}- \\ | \\ \text{H} \end{array}$; the sulfoxide group $\begin{array}{c} \text{O} \\ \parallel \\ -\text{S}- \\ | \\ \text{H} \end{array}$; the

azo-group $-\text{N}=\text{N}-$; the saturated fluoro-carbon groups $-\text{CF}_2\text{CF}_2-$; organic phos-

phine oxides $\begin{array}{c} \text{O} \\ \parallel \\ -\text{P}- \\ | \\ \text{R} \end{array}$; where R is a hydro-

carbon group, and the ethylidene group $\begin{array}{c} \text{X}-\text{C}-\text{X} \\ \parallel \\ -\text{C}- \end{array}$ where X can be hydrogen or halogen

or which can activate halogens on the same ring such as with difluorobenzoquinone, 1,4- or 1,5- or 1,8-difluoroanthraquinone.

[B]

Those skilled in the art will understand that a plurality of electron withdrawing groups may be employed if desired, including electron withdrawing groups having a sigma* value below about +0.7 provided the cumulative sigma* influence on each of the reactive halogen groups of the halobenzenoid compound is at least about +0.7.

The Disclosure and Prosecution History of the 1963 Application

To understand the written description issue in this appeal, it is necessary to summarize the disclosure and prosecution history of the 1963 application. The 1963 application described (and claimed) in haec verba a genus of polymers as defined by the above general formula. That application stated:

The high molecular weight polyarylene polyethers of the present invention are the linear thermoplastic reaction products of an alkali metal double salt of a dihydric phenol and a dihalobenzenoid compound. Characteristically, this polymer has a basic structure composed of recurring units having the formula

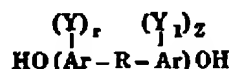


wherein E is the residuum of the dihydric phenol and E' is the residuum of the benzenoid compound, both of which are valently bonded to the ether oxygen through aromatic carbon atoms, as hereinafter more fully discussed. Polymers of this type exhibit excellent strength and toughness properties as well as outstanding thermal, oxidative and chemical stability.

The 1963 application then discussed the identity of E and the E' precursor compound, that is, the compound which is the predecessor of E in the general formula. It stated:

The residuum E of the dihydric phenol of these alkali metal salts is not narrowly critical. It can be, for instance, a mononuclear phenylene group as results from hydroquinone and resorcinol, or it may be a di- or polynuclear residuum. Likewise it is possible that the residuum be substituted with other inert nuclear substituents such as halogen, alkyl, alkoxy and like inert substituents.

Such dinuclear phenols can be characterized as having the structure:



wherein Ar is an aromatic group and preferably is a phenylene group, Y and Y' can be the same or different inert substituent groups as alkyl groups having from 1 to 4 carbon atoms, halogen atoms, i. e. fluorine, chlorine, bromine or iodine, or alkoxy radicals having from 1 to 4 carbon atoms, r and z are integers having a value from 0 to 4, inclusive, and R is representative of a bond between aromatic carbon atoms as in dihydroxydiphenyl, or is a divalent radical, including for

example, inorganic radicals as $\begin{array}{c} \text{O} \\ \parallel \\ -\text{C}-, -\text{O}-, \\ -\text{S}-, -\text{S}-\text{S}-, -\text{SO}_2-, \end{array}$ and divalent organic hydrocarbon radicals such as alkylene, alkylidene, cycloaliphatic, or the

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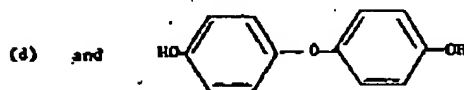
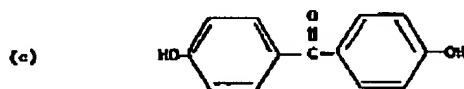
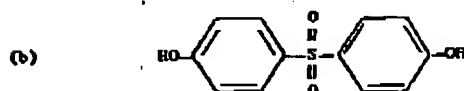
halogen, alkyl, aryl or like substituted alkylene, alkylidene and cycloaliphatic radicals as well as alkaliyclic, alkarylene and aromatic radicals and a ring fused to both Ar group[s].

The application then mentioned by name some fifty specific dihydric dinuclear phenol (bisphenol) compounds which could be the E precursor compound. The application further stated:

A preferred form of the polyarylene polyethers of this invention are those prepared using the dihydric polynuclear phenols of the following four types, including the derivatives thereof which are substituted with inert substituent groups



in which the R group represents hydrogen, lower alkyl, lower aryl and the halogen substituted groups thereof, which can be the same or different.



Turning to the identity of the E' precursor compound, the application stated:

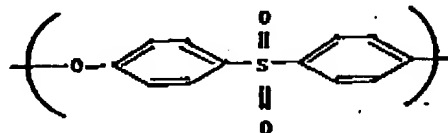
Any dihalobenzenoid compound or mixture of dihalobenzenoid compounds can be employed in this invention which compound or compounds has the two halogens bonded to benzene rings having an electron withdrawing group in at least one of the positions ortho and para to the

halogen group. The dihalobenzenoid compound can be either mononuclear where the halogens are attached to the same benzenoid ring, or polynuclear where they are attached to different benzenoid rings, as long as there is the activating electron withdrawing group in the ortho or para position of that benzenoid nucleus.

The 1963 application also included a discussion of the electron withdrawing group that was substantially the same as the paragraphs quoted above from the 1972 application.

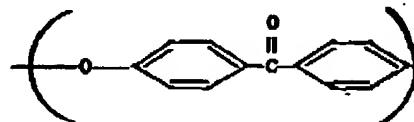
The 1963 application contained twenty-six "examples" disclosing in detail the physical and chemical characteristics of fifteen species of polyarylene polyethers. One of the species was the polymer composed of these recurring structural units (which we designate as species [1]):⁸

[1]



Another species disclosed was the polymer composed of these recurring structural units (which we designate as species [2]):⁹

[2]



Appellants' 1963 application became involved in a three-party interference¹⁰ which resulted in an award of priority adverse to appellants from which they did not appeal.¹¹ The sole count of the interference recited species [1].

8. The -SO₂- linking group in species [1] is called a sulfone group.

9. The -CO- linking group in species [2] is called a carbonyl group.

10. Interference No. 95,807, declared February 17, 1967.

11. Another party did appeal. See *Vogel v. Jones*, 488 F.2d 1068, 179 USPQ 425 (Cust. & Pat.App.1973).

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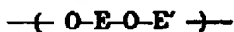
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After their involvement in the interference ended, appellants filed the 1972 application, and they sought broad claims which would at the same time exclude the subject matter of the lost count.

The Claims

Claim 1, now on appeal, is illustrative of the group of claims (claims 1-9, 64, and 68-70) which seek to exclude the subject matter of the lost count and which are involved in the 35 U.S.C. §§ 102 or 103 rejection:

1. A substantially linear thermoplastic polyarylene polyether composed of recurring units having the general formula:



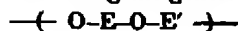
where E is the residuum of a dihydric phenol and E' is the residuum of a benzenoid compound having an inert electron withdrawing group in one or more of the positions ortho and para to the valence bonds having a sigma * value above about +0.7, and where both of said residuum [sic, residual] are valently bonded to the ether oxygens through aromatic carbon atoms with the provisos that E and E' may not both include a divalent sulfone group and may not both include a divalent carbonyl group linking two aromatic nuclei. [Emphasis added.]

The first "proviso" in claim 1, that "E and E' may not both include a divalent sulfone group," excludes species [1], the species of the lost count. The second "proviso," that "E and E' * * * may not both include a divalent carbonyl group," excludes species [2], which appellants state is "analogous" or "equivalent" to species [1].¹²

Claims 64 and 71 are illustrative of the group of claims (claims 64 and 68-72) rejected under 35 U.S.C. § 112, first and second paragraphs:

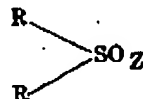
12. The provisos actually exclude more than species [1] and [2]. For example, polymers

64. A substantially linear thermoplastic polyarylene polyether composed of recurring units having the general formula:



where E is the residuum of a dihydric phenol and E' is the residuum of a benzenoid compound having one or more inert electron withdrawing groups in at least one of the position [sic, positions] ortho and para to the valence bonds having a sigma * value sufficient to activate a halogen atom and where both of said residuum [sic, residual] are valently bonded to the ether oxygens through aromatic carbon atoms with the provisos that E and E' may not both include a divalent carbonyl group linking two aromatic nuclei. [Emphasis added.]

71. The process for preparing substantially linear polyarylene polyethers which comprises reacting substantially equimolar amounts of an alkali metal double salt of a dihydric phenol with a dihalobenzenoid compound having halogen atoms activated by an inert electron withdrawing group in at least one of the positions ortho and para to the halogen atom, under substantially anhydrous conditions and in the liquid phase of an organic solvent having the formula:



in which R represents a member of the group consisting of monovalent lower hydrocarbon groups free of aliphatic unsaturation on the alpha carbon atom and, when connected together represents a divalent alkylene group, and Z is an integer from 1 to 2 inclusive. [Emphasis added.]

The Rejections

The sole reference relied upon by the examiner and the board is:

Netherlands 6,408,130 January 18, 1965

similar to species [1] and [2] but having substituted ring structures are also excluded.

Claims 1-9, 64, and 68-70 were rejected under 35 U.S.C. §§ 102 or 103 as unpatentable in view of the Netherlands patent, which is a foreign-filed counterpart of appellants' 1963 application.

Before the PTO, appellants conceded that the invention was fully disclosed in the Netherlands patent. However, appellants contended that the claims are entitled to the benefit of the 1963 filing date under 35 U.S.C. § 120,¹³ and therefore the Netherlands patent is not available as a prior art reference.

The examiner and the board were of the view that the claims are not entitled to the 1963 filing date because the presently claimed subject matter is not "described" in the 1963 application as required by the first paragraph of 35 U.S.C. § 112.¹⁴ As explained by the board:

The question determinative of the issue at hand is thus whether or not appellants are entitled to the filing date of their parent application Serial No. 295,519, i. e., July 16, 1963. An answer to this question quite obviously depends on what is the invention defined by the instant claims. It is the same as the one disclosed in [the] parent case or does it differ therefrom in a manner which precludes the instant claims from being afforded the filing date of the parent case?

Under the rationale of the CCPA as set forth in *In re Welstead*, 463 F.2d 1110, 59 CCPA 1105, 174 USPQ 449 (compare also *In re Lukach et al.*, 442 F.2d 967, 58 CCPA 1233, 169 USPQ 795, and *In re Smith [(I)]*, 458 F.2d 1389, 59 CCPA 1025.

13. § 120. Benefit of earlier filing date in the United States.

An application for patent for an invention disclosed in the manner provided by the first paragraph of section 112 of this title in an application previously filed in the United States by the same inventor shall have the same effect, as to such invention, as though filed on the date of the prior application, if filed before the patenting or abandonment of or termination of proceedings on the first application or on an application similarly entitled to the benefit of the filing date of the first application and if it contains or is amended to contain a specif-

173 USPQ 679), which we deem controlling, we are constrained to conclude that the present claims are not entitled to the filing date of appellants' parent case Serial No. 295,519. The claims at issue contain provisos that E and E' may not both include a divalent sulfone group and may not both include a divalent carbonyl group linking two aromatic nuclei. The artificial subgenus thus created in the claims is not described in the parent case and would be new matter if introduced into the parent case. It is thus equally "new matter," i. e., matter new to the present application for which no antecedent basis exists in the parent case. Consequently, appellants are not entitled to rely on the filing date of their parent case to support a new subgenus for which no basis exists in the parent case. The reason why appellants now limit their claims to exclude those species eliminated by the provisos, i. e., loss in an interference, is manifestly immaterial.

Having reached the conclusion that appellants are not entitled to the filing date of their parent case for the subject matter defined by the present claims which delineate a new subgenus not described in the parent case, it follows that the Netherlands patent is a valid reference which, by appellants' own admission, fully meets the claims. The indicated rejection of claims 1-9, 64 and 68-70 under 35 U.S.C. 102 as unpatentable over the Netherlands patent is thus affirmed. The alternative reliance by the Examiner on Section 103 is inconsequential, Section 102 of the statute being the epitome of Section 103. In

ic reference to the earlier filed application. [Emphasis added.]

14. § 112. Specification.

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention. [Emphasis added.]

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re Pearson, (Cust. & Pat.App.), 494 F.2d 1399, 181 USPQ 641.

Claims 64 and 68-72 were rejected under 35 U.S.C. § 112, first and second paragraphs. In his Answer, the examiner stated that the claims were rejected under § 112, first paragraph, for "being broader than the enabling disclosure" and under § 112, second paragraph,¹⁵ for being "broader than the express limitations disclosed as defining the invention." The examiner said the "specific deficiencies of the claims and disclosure" are that the expression "to activate a halogen" (claim 64) is "indefinite" because "it does not specify toward what the activation is" and that "[t]he express disclosure is clearly limited to the sigma * value recited in claim 1, for example: see [A] and [B]."

In affirming the examiner on these rejections, the board stated:

Further, claims 64 and 68-72 stand finally rejected under 35 U.S.C. 112 as being broader than the enabling disclosure (first paragraph) and broader than the express limitations disclosed as defining the invention (paragraph two).

It is the Examiner's position that "to activate a halogen atom" (claim 64) is indefinite and that the disclosure also is limited to dihalobenzenoid compounds not broadly merely "activated by an inert electron withdrawing group" (claims 68-72) but the activation must have a sigma * value above about +0.7.

We agree with this rejection. The specification makes it quite clear that a minimum sigma * activation value of the halogen atoms is required (note especially [A]) and an undefined sigma * value thus lacks the requisite preciseness commensurate with the enablement of the disclosure.

15. § 112. Specification.

The specification shall conclude with one or more claims particularly pointing out and dis-

OPINION

1. The Rejections of Claims 64 and 68-72 under § 112

Claims 64 and 68-72 were rejected under both the first and second paragraphs of 35 U.S.C. § 112.

[1] We begin with the rejections under the second paragraph of § 112. As stated in *In re Moore*, 439 F.2d 1232, 1235, 58 CCPA 1042, 1046-1047, 169 USPQ 236, 238 (1971):

Any analysis in this regard should begin with the determination of whether the claims satisfy the requirements of the second paragraph. * * *

This first inquiry therefore is merely to determine whether the claims do, in fact, set out and circumscribe a particular area with a reasonable degree of precision and particularity. It is here where the definiteness of the language employed must be analyzed—not in a vacuum, but always in light of the teachings of the prior art and of the particular application disclosure as it would be interpreted by one possessing the ordinary level of skill in the pertinent art. [Footnote omitted.]

The examiner's § 112, second paragraph, rejection was premised on the general ground that the claims are "broader than the express limitations disclosed as defining the invention" and on two specific grounds: (a) that the expression "to activate a halogen atom" is "indefinite" because "it does not specify toward what the activation is;" and (b) that "[t]he express disclosure is clearly limited to the sigma * value recited in claim 1, for example: see [A] and [B]."

The board affirmed and stated: "an undefined sigma * value thus lacks the requisite preciseness * * *." (Emphasis added.)

Ground (a) focuses on the specific phrase "to activate a halogen atom." But the language is found only in claim 64, not in claims 68-72. Claim 68 recites "a dihalobenzenoid compound having halogen atoms activated by an inert electron withdrawing group," and claims 71 and 72 have a similar recitation. (Claims 69 and 70 depend from

claim 64 and claim 73 depends from claim 72, each distinctly claiming the subject matter which the applicant regards as his invention.

claim 68.) Those recitations clearly specify "toward what the activation is," as the examiner would require. Ground (a), therefore, lacks merit with respect to claims 68-72.

[2] Product claim 64¹⁶ defines the complete polymer structure by describing the constituents partially in terms of their functions in the reaction and by their linkage into the end-product polymer. The specification provides further guidance on the meaning of the E' term:

It is seen also that as used herein, the E' term defined as being the "residuum of the benzenoid compound" refers to the aromatic or benzenoid residue of the compound after the removal of the halogen atoms on the benzenoid nucleus. [Emphasis added.]

It is also clear from the specification as a whole, that two keys to the polymerization reaction are inert electron withdrawing groups particularly positioned on the benzenoid nucleus and a cumulative sigma * value attributable to those withdrawing groups which is sufficient to activate a halogen atom on that nucleus. If the sigma * value is not sufficient to activate a halogen atom on the benzenoid nucleus, the reaction will not take place and the polymer will not be made. See *In re Angstadt*, 537 F.2d 498, 190 USPQ 214 (Cust. & Pat.App.1976). The specification adequately details which sigma * values are sufficient to carry out the reaction, and any person skilled in the art would immediately recognize from the above-quoted portion of the disclosure or the specification as a whole that the halogen atom mentioned in claim 64 was on the benzenoid nucleus prior to the reaction. It is clear that those skilled in the art would have no trouble ascertaining whether any particular polymer falls within the scope of

claim 64. See *In re Goffe*, 526 F.2d 1393, 188 USPQ 131 (Cust. & Pat.App.1975). The questioned limitation is merely surplusage, since the claim would be definite with or without it.¹⁷

[3, 4] The point made by the board, that "an undefined sigma * value" lacks "preciseness," is also unsound.¹⁸ Claim language must be read in light of the specification as it would be interpreted by one of ordinary skill in the art. *In re Moore*, supra. As pointed out above, those skilled in the art will be able to determine immediately from appellants' detailed specification what level of activation (i. e., sigma * value) is necessary to practice the invention. Cf. *In re Mattison*, 509 F.2d 563, 184 USPQ 484 (Cust. & Pat.App.1975). We conclude that the subject matter embraced by claims 64 and 68-72 is definite and that the claims set out and circumscribe a particular area with a reasonable degree of precision and particularity. *In re Angstadt*, supra; *In re Skoll*, 523 F.2d 1392, 187 USPQ 481 (Cust. & Pat.App.1975); *In re Watson*, 517 F.2d 465, 186 USPQ 11 (Cust. & Pat.App.1975); *In re Moore*, supra. Therefore, the rejection of claims 64 and 68-72 under the second paragraph of 35 U.S.C. § 112 is reversed.

The examiner's general ground and his ground (b) raise a lack of enablement issue properly arising under the first, not the second, paragraph of § 112. Ground (b) simply supplies the examiner's reasoning in support of the rejection of the claims under § 112, first paragraph, as "broader than the enabling disclosure."

As appellants state, the crux of this lack of enablement rejection is that although the specification describes how the halogen atoms bonded to the dihalobenzenoid compound (the E' precursor compound) must be activated in order for polymerization to oc-

16. Claims 68-70 are product-by-process claims.

17. We do not speculate on whether or not the claim would be unduly broad if the questioned limitation were removed. But undue breadth is not indefiniteness. *In re Borkowski*, 422 F.2d 904, 57 CCPA 946, 164 USPQ 642 (1970). This claim is definite either with or without the phrase "to activate a halogen atom."

18. *In re Merat*, 519 F.2d 1390, 186 USPQ 471 (Cust. & Pat.App.1975), cited by the Solicitor, affirmed a § 112, second paragraph, rejection because the same word ("normal") was used in the claims in one sense and in the specification in a different sense, thus rendering the claims indefinite. There is nothing akin to the *Merat* situation here.

APPLICATION OF JOHNSON

Cite as 558 F.2d 1008 (1977)

1017

cur, the claims at issue do not recite a numerical definition of the degree of activation (a minimum sigma * value) required from the electron withdrawing group. The PTO position is that the claims must recite a minimum sigma * value in order to conform the scope of the claims to the scope of enablement provided by the specification. The PTO relies on statements [A] and [B] to prove that the scope of enablement provided by the specification is not commensurate with the scope of the claims.

[5] First, we note that it is the function of the specification, not the claims, to set forth the "practical limits of operation" of an invention. *In re Rainer*, 305 F.2d 505, 509, 49 CCPA 1243, 1248, 134 USPQ 343, 346 (1962). One does not look to claims to find out how to practice the invention they define, but to the specification. *In re Roberts*, 470 F.2d 1399, 1403, 176 USPQ 313, 315 (Cust. & Pat.App.1973); *In re Fuetterer*, 319 F.2d 259, 50 CCPA 1453, 138 USPQ 217 (1963).

[6] Second, we note that the specification as a whole must be considered in determining whether the scope of enablement provided by the specification is commensurate with the scope of the claims. *In re Moore*, supra, 439 F.2d at 1235, 58 CCPA at 1047, 169 USPQ at 238-39.

The present specification includes broad statements such as: "Any electron withdrawing group can be employed as the activator group in these compounds." The specification also discusses preferred embodiments, alternative embodiments, and the practical limits of operation.

Statement [A] describes preferred embodiments and practical limits of operation. It says that electron withdrawing groups having a high sigma * value ("preferably above 1.0") are preferred and that the practical limit of operation of the polymerization reaction is reached when the electron withdrawing group has a sigma * value of 0.7 (at that value the reaction rate "may be somewhat low").

Statement [B] describes an alternative embodiment ("a plurality of electron withdrawing groups") and the practical limit of operation for this embodiment. It states that the cumulative sigma * influence should be "at least about +0.7."

[7,8] The PTO would limit appellants to claims reciting a sigma * value of at least 0.7. This view is improper because it requires the claims to set forth the practical limits of operation for the invention and it effectively ignores the scope of enablement provided by the specification as a whole. As we said in *In re Goffe*, 542 F.2d 564, 567, 191 USPQ 429, 431 (Cust. & Pat.App.1976):

[T]o provide effective incentives, claims must adequately protect inventors. To demand that the first to disclose shall limit his claims to what he has found will work or to materials which meet the guidelines specified for "preferred" materials in a process such as the one herein involved would not serve the constitutional purpose of promoting progress in the useful arts. See *In re Fuetterer*, 319 F.2d 259, 265, 50 CCPA 1453, 1462, 138 USPQ 217, 223 (1963). [Footnote omitted.]

The rejection of claims 64 and 68-72 under the first paragraph of 35 U.S.C. § 112 is reversed.

II. The Rejection of Claims 1-9, 64, and 68-70 Under § 102 or § 103, Raising Issues Under § 112 and § 120

[9] We are convinced that the invention recited in claim 1 is "disclosed in the manner provided by the first paragraph of section 112" in the 1963 application and that claim 1 is therefore entitled to the benefit of the 1963 filing date.¹⁹ The only inquiry is whether, after exclusion from the original claims of two species specifically disclosed in the 1963 application, the 1963 dis-

19. Appellants have not argued the claims separately, thus, claims 2-8, 64, and 68-70 stand or fall with claim 1.

closure satisfies § 112, first paragraph, for the "limited genus"²⁰ now claimed.

While the board found that "no antecedent basis exists in the parent case" for the "limited genus" in claim 1, we see more than ample basis for claims of such scope. The 1963 disclosure is clearly directed to polymers of the type claimed. Fifty specific choices are mentioned for the E precursor compound, a broad class is identified as embracing suitable choices for the E' precursor compound, and twenty-six "examples" are disclosed which detail fifteen species of polyarylene polyethers. Only fourteen of those species and twenty-three of the "examples" are within the scope of the claims now on appeal. Two of the many choices for E and E' precursor compounds are deleted from the protection sought, because appellant is claiming less than the full scope of his disclosure. But, as we said in *In re Wertheim*, 541 F.2d 267, 263, 191 USPQ 90, 97 (Cust. & Pat.App.1976):

Inventions are constantly made which turn out not to be patentable, and applicants frequently discover during the course of prosecution that only a part of what they invented and originally claimed is patentable.

[10] It is for the inventor to decide what bounds of protection he will seek. *In re Saunders*, 444 F.2d 599, 607, 58 CCPA 1316, 1327, 170 USPQ 213, 220 (1971). To deny appellants the benefit of their grandparent application in this case would, as this court said in *Saunders*:

* * * let form triumph over substance, substantially eliminating the right of an applicant to retreat to an otherwise patentable species merely because he erroneously thought he was first with the genus when he filed.

The board cited as "controlling" the decisions of this court in *In re Welstead*, 463 F.2d 1110, 59 CCPA 1105, 174 USPQ 449 (1972); *In re Lukach*, 442 F.2d 967, 58 CCPA 1233, 169 USPQ 795 (1971); and *In re Smith*, 458 F.2d 1389, 59 CCPA 1025, 173

20. Appellants refer to the subject matter recited in claim 1 as a "limited genus." The board called it an "artificial subgenus." We use ap-

USPQ 679 (1972). Those decisions, because of important factual distinctions, are not controlling.

In *Welstead* the applicant was attempting to introduce into his claims a new subgenus where " * * * the specification * * * contained neither a description * * * of the [subgenus] * * * nor descriptions of the species thereof amounting in the aggregate to the same thing * * *." *Welstead* conceded the absence from his disclosure of compounds of the "second type" within the new subgenus. *Welstead* is thus clearly distinguishable from the present case, in which appellants' grandparent application contains a broad and complete generic disclosure, coupled with extensive examples fully supportive of the limited genus now claimed. Indeed, *Welstead* might have well been cited by the board in support of a decision contrary to that reached, in view of what this court there implied concerning the possibility that "descriptions of species amounting in the aggregate to the same thing" may satisfy the description requirements of 35 U.S.C. § 112, paragraph one.

Similarly, in *Lukach* we noted that " * * * the grandparent application here does not disclose any defined genus of which the presently claimed copolymers are a subgenus." That is not the fact here. Appellants' grandparent application clearly describes the genus and the two special classes of polymer materials excluded therefrom.

In *Smith* the applicant sought the benefit of his prior application for a broadened generic claim, replacing the claim limitation "at least 12 carbon atoms * * *" with a new limitation calling specifically for 8 to 36 carbon atoms, where there was no disclosure of either the range itself or of a sufficient number of species to establish entitlement to the claimed range. Appellants, in contrast to the applicant in *Smith*, are narrowing their claims, and the full scope of the limited genus now claimed is supported in appellants' earlier application, generically and by specific examples.

pellants' terminology. Whatever the label, the issue is the same.

WELLA CORP. v. CALIFORNIA CONCEPT CORP.

1019

Cite as 558 F.2d 1019 (1977)

The notion that one who fully discloses, and teaches those skilled in the art how to make and use, a genus and numerous species therewithin, has somehow failed to disclose, and teach those skilled in the art how to make and use, that genus minus two of those species, and has thus failed to satisfy the requirements of § 112, first paragraph, appears to result from a hypertechnical application of legalistic prose relating to that provision of the statute. All that happened here is that appellants narrowed their claims to avoid having them read on a lost interference count.

The board indicated that "it is manifestly immaterial" why appellants limited their claims. Though it is true that insufficiency under § 112 could not be cured by citing the causes for such insufficiency, it is not true that the factual context out of which the question under § 112 arises is immaterial. Quite the contrary. Here, as we hold on the facts of this case, the "written description" in the 1963 specification supported the claims in the absence of the limitation, and that specification, having described the whole, necessarily described the part remaining. The facts of the prosecution are properly presented and relied on, under these circumstances, to indicate that appellants are merely excising the invention of another, to which they are not entitled, and are not creating an "artificial subgenus" or claiming "new matter."

In summary, and for the reasons discussed, the rejections of claims 64 and 68-72 under § 112, first and second paragraphs, are reversed; appellants' 1963 disclosure satisfied § 112, first paragraph, with respect to claims 1-9, 64, and 68-70 and appellants are, therefore, entitled to the benefit of their 1963 filing date under 35 U.S.C. § 120. The Netherlands patent is thus rendered unavailable as a prior art reference, and the rejection of the claims under 35 U.S.C. §§ 102 or 103 is reversed.

REVERSED

LANE, Judge, dissenting in part.

I would affirm the rejection of claims 64 and 68-72 under § 112, paragraphs 1 and 2,

because the specification indicates that a minimum sigma value of +0.7 is an essential requisite. These claims fail to recite this requisite, thus fail to define appellants' invention and are broader than the disclosure. I concur in reversing the rejection of claims 1-9.



The WELLA CORPORATION, Appellant,

v.

CALIFORNIA CONCEPT
CORPORATION,
Appellee.

Patent Appeal No. 77-503.

United States Court of Customs
and Patent Appeals.

July 14, 1977.

Appeal was taken from decision of Trademark Trial and Appeal Board dismissing appellant's opposition filed against application for registration of trademark for men's cologne, men's hairspray, men's hair conditioner and men's hair shampoo, and denying appellant's petition for cancellation of appellees' trademark for hair shampoo and men's cosmetics. The Court of Customs and Patent Appeals, Miller, J., held that: (1) appellee's marks, when applied to respectively described goods, so resembled appellant's registered mark as to be likely to cause confusion or mistake, or to deceive; (2) absence of instances of actual confusion was not probative where there had been only a short period of time in which both parties had concurrently enjoyed commercial success in their operation, and (3) under circumstances, appellee would be assessed printing costs for certain pages of transcript.

Reversed.

APPENDIX C

CORN'S BIOLOGICAL STAINS

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quadruple stains with orcein (Mollier, 1936) or resorcin fuchsin (Volkman and Strauss, 1934) and in variants for anterior pituitary cells.

The effect of the two dyes is essentially the same and many biologists fail to state which they used. Azocarmine G is sparingly soluble in water; a solution prepared by boiling 1 g in 100 ml is apparently supersaturated. Azocarmine B is freely soluble; 1-2% solutions in cold water or 1% acetic acid are readily prepared. Hence, modern texts usually prescribe azocarmine B, if they take the trouble to discriminate. Normal lightfastness is given at 3 for both dyes. Both dyes are precipitated by HCl.

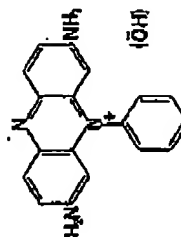
A spectral curve for azocarmine G, together with one for neutral red, is given in Fig. 15.1, p. 378.

The name azocarmine should be written as one word to avoid confusion with the azo dyes.

See *Staining Procedures*, p. 58, for Heidenhain's azan technic; p. 64 for Mollier's orcein, azocarmine, phosphotungstic acid, naphthol green B quadruple stain; and pp. 171 and 173, for Gomori azan variants for islet cells.

Safranins

Quite a long series of azin dyes are known in which one of the nitrogen atoms of the azin group is pentavalent and another benzene ring is attached to it. This pentavalent nitrogen allows the compounds to behave like ammonium bases; so with the amino groups which are always present, the basic properties of these dyes are very strong. The theoretical base of the simplest safranin would have the formula:



This form of ammonium base does not actually exist, as the safranin bases really occur in the form of anhydrides, but salts of these ammonium bases are the commonly known dyes. The commercial dyes are ordinarily chlorides.

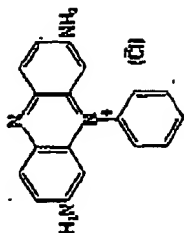
There are two groups of safranins: the benzosafranins in which the azin group unites two benzene rings; and the naphthosafranins in which it unites two naphthalene groups. The simplest safranin is phenosafranin, which is the chloride of the theoretical base just given, namely:

PHENOSAFRANIN (7)

C.I. 50200

Synonyms: *Safranin B extra*

QUINONE-IMINE DYES



$C_{22}H_{14}N_4Cl$ mol. wt. 322.800

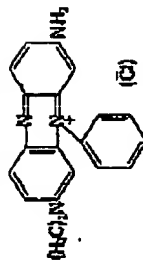
Phenosafranin is soluble in water and in alcohol with red colors, dil. solution has a greenish yellow fluorescence. Moore (1933) calls phenosafranin in staining colonies of bacteria and fungi. The commercial safranins are ordinarily methyl or ethyl substitution products of occasionally phenyl substitution products. The one of greatest value to the biologist is generally safranin O.

METHYLENE VIOLET RR (FIAT)

(C.I. Basic Violet 5)

Synonyms: *Safranin*, bluish, *Safranin 6B* or *6B*, *Methylene violet 3*, to be confused with *Methylene violet 3RAX* conc. which is C.I. 51 with *Berthsen's Methylene violet* which is an oxidation product of *Methylene blue*, *Dimethylphenosafranin*

N,N' -Dimethylsafranin



$C_{24}H_{16}N_4Cl$ mol. wt. 350.854

This is a violet basic dye of the safranin group which is soluble in alcohol and very soluble in alcohol and soluble in Cellosolve.

It has some use in histology as a basic dye, is somewhat more bluish than safranin O and has proved an excellent replacement for that preparation of a fresh diazonium salt for study of the azo compounds in tissue sections, to which it imparts a bluish red color. Enterchromaffin is black, as are most cell granules in some species of Lillie and Pizzolatoro (1970) have combined freshly diazotized methylene blue in 1 N acetic acid with a preceding Prussian blue reaction for differential staining of hematoxylin (red to violet) and hemocytin (blue).

C.I. 50208, *Methylene Violet 3RAX (FIAT)* conc. or diethylphenosafranin ($C_{22}H_{14}N_4Cl$ mol. wt. 378.858), is used in the dye industry as an intermediate in the manufacture of Janus green B, C.I. 1101

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uss, 1934) and in variants for anterior pituitary cells.

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which they used. Azocarmine G is sparingly soluble in water, a
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if they take the trouble to discriminate. Normal lightfastness is
3 for both dyes. Both dyes are precipitated by HCl.

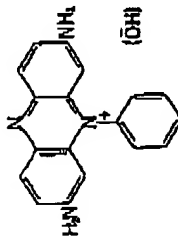
stral curve for azocarmine G, together with one for neutral red, is
Fig. 15.1, p. 379.

ame azocarmine should be written as one word to avoid confusion
azo dyes.

aining. Procedures, p. 56, for Heidenhain's azan technique, p. 64, for
s orcein, azocarmine, phosphotungstic acid, naphthol green B
le stain; and pp. 171 and 173, for Gomori azan variants for islet

Safranins

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This pentavalent nitrogen allows the compounds to behave like
inium bases, so with the amino groups which are always present, the
properties of these dyes are very strong. The theoretical base of the
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occur in the form of anhydrides, but salts of these ammonium bases
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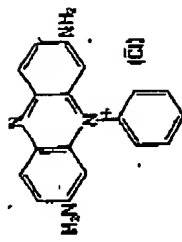
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unites two benzene rings; and the naphthosafranins in which it unites
aphthalene groups. The simplest safranin is phenosafranin, which is
loride of the theoretical base just given, namely:

PHENOSAFRANIN (7H)

C.I. 50200

Synonym: Safranin B extra

QUINONE-IMINE DYES



C₁₈H₁₃N₃Cl; mol. wt. 322.800

Phenosafranin is soluble in water and in alcohol with red colors, the alco-
hol solution has a greenish yellow fluorescence. Moure (1933) called for
phenosafranin in staining colonies of bacteria and fungi. The commercial
safranins are ordinarily methyl or ethyl substitution products of this; or
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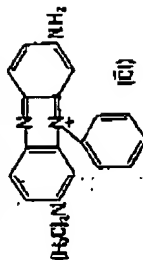
METHYLENE VIOLET 6B (FIAT)

(C.I. Basic Violet 5)

C.I. 50205

Synonyms: Safranin, bluish, Safranin 6B or 8B, Methylene violet 3RD (not
to be confused with Methylene violet 3RAX conc. which is C.I. 50206, or
with Bernthsen's Methylene violet which is an oxidation product of
Methylene blue), Dimethylphenosafranin

N,N-Dimethylsafranin



C₁₈H₁₅N₃Cl; mol. wt. 350.854

This is a violet basic dye of the safranin group which is soluble in water
and very soluble in alcohol and soluble in Cellosolve.

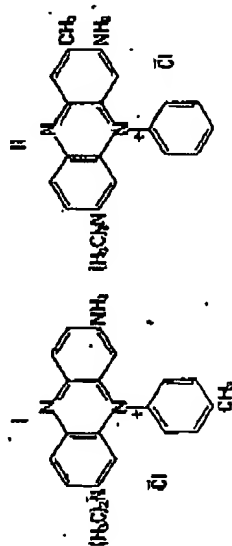
It has some use in histology as a basic dye, is somewhat more bluish than
safranin O and has proved an excellent replacement for that dye in
preparation of a fresh diazonium salt for study of the azo coupling of
proteins in tissue sections, to which it imparts a bluish red color.
Enterchromaffin is black, as are most cell granules in some species.

Lillie and Pizzolato (1970) have combined freshly diazotized methylene
violet in 1 N acetic acid with a preceding Prussian blue reaction for
differential staining of hematoxylin (red to violet) and hemosiderin (greenish
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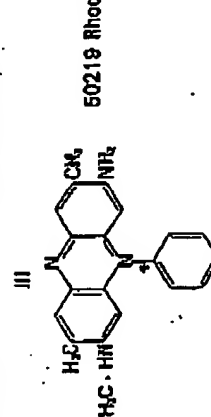
C.I. 60206, Methylene Violet 3RAX (FIAT) conc. or diethylphenosa-
franin (C₂₀H₁₉N₃Cl, mol. wt. 378.858), is used in the dye industry as an
intermediate in the manufacture of Janus green B, C.I. 11050, and

"Copierschwarz," C.I. 11080. It is occasionally called for in histochemistry as a fresh diazonium salt, but it seems indicated that the lower homolog C.I. 50205 has usually been furnished. However, it appears also in the list of intermediates in the *Colour Index* as phenazinium chloride, 3-amino-7-diethylamino-5-phenyl, and can probably be obtained under that name.

Three further safranins are included under C.I. Nos. 50210 and 50215. C.I. 50210 in the 1971 *Colour Index* is a mixture of a diphenyltoluosafranin (I) and Rhoduline Violet (II). C.I. 50215 includes Rhoduline Violet (II) and Rhoduline Red G (III). C.I. Basic Violet 8, C.I. 50210, has the commercial names Safranin HMN(FH), Brilliant Heliotrope 2R (LDH), and Brilliant Helio Safranin N (LDH). Gurr (1960) formulates two dyes which he names Safranin 6B and Rhodulin Violet, formulating both identically with Rhoduline Violet (II), but giving quite different solubility data—Safranin 6B, to add to the confusion, is a synonym of Methylene Violet RR, C.I. 50205.



C₂₁H₂₁N₃Cl
mol. wt. 364.881



C₂₁H₂₁N₃Cl
mol. wt. 364.881

Dye	Water	Alcohol	Cellulose	Glycerol	Xylene
Gurr's Safranin 6B	7.0	6.5	7.25	6.5	0.0
Rhodulin Violet	3.0	20.0	4.25	6.3	0.0

The *Colour Index* lists the dyes as soluble in water and alcohol with red colors.

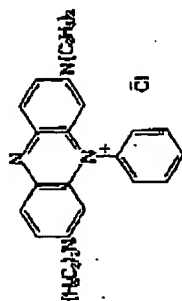
AMETHYST VIOLET (Tr)

C.I. 50225

Synonyms: Heliotrope B (Pr); Iris violet

QUINONE-IMINE DYES

This dye is tetraethyl phenosafranin:



C₂₅H₂₉N₃Cl, mol. wt. 435.017
(A basic dye; absorption maxima about 589, (545.5))
Solubility at 26°C: in water 3.12%, in alcohol 3.66%

Amethyst violet was used by Ehrlich and Lazarus (1898) as a basic certain triple staining technique.

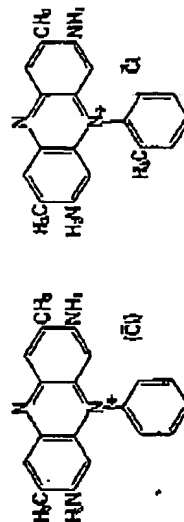
SAFRANIN O, T (Cl, FIAT)
(C.I. Basic Red 2)

Classical name: Safranin

Synonyms: Safranin Y or A; Gossypimine; Cotton red

Slightly different shades: Safranin AQ, T, MP, and G. (Although included in C.I. 50240 they are different from the grade here desc

The common safranins of commerce, under various shade designations are mixtures of dimethyl and trimethyl phenosafranin. Only these formulas are accepted in the 2nd edition of the *Colour Index* as T, and the final coupling of the phenazin is with aniline alone, not with toluidine.



C₂₁H₂₁N₃Cl, mol. wt. 360.854 C₂₁H₂₁N₃Cl, mol. wt. 364.881
(A basic dye; absorption maximum about 530)
Solubility at 36°C: in water 5.45%; in alcohol 3.4%

The shade differs according to the proportion of these compounds present, the red being deeper according to the proportion of the compound in the mixture. The type safranin O, which proves ordinary biological purposes, can be defined as having its absorption maximum at 530 nm.

A spectral curve of safranin O is given in Fig. 16.2.

H. J. CONN'S Biological Stains

NINTH EDITION

*a handbook on the
nature and uses of the
dyes employed in
the biological laboratory*

R. D. LILLIE, M.D.

*prepared with the collaboration of various members
of the Biological Stain Commission*

Revised with the assistance of

**E. H. STOTZ, Ph.D. and
V. M. EMMEL, Ph.D., M.D.**

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H. J. Conn

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PREFACE TO THE NINTH EDITION

As we reached the last month before press time for this edition to us of Dr. Conn's death on November 10, 1976. More than individual he was the founder of the Biological Stain Commission author of its major publications, *Stain Technology*, *Staining Practice History of Staining*, and, not least, of this book. The last, *Biological Stains*, now entering on its ninth edition, stands monument to him. He carried it through seven successful editions which well reflected the great expansion in the uses of "Biological" not only as colors for tissues, but as agents altering the growth organisms, as redox and pH indicators in chemistry and biology we have made important changes in the eighth and ninth editions the text is scarcely altered from his last revision.

In this edition we have adopted a new concept, that staining to be regarded as a variety of dyeing using natural and synthetic organic reagents. In fact this was not true before, for many organic reagents in their usual uses as combinations of the dyes functioned in their usual uses as combinations of the dyes metallic salt applied before, with, or after the dye.

We now regard staining on the optical microscope level as the of colored reaction products of tissues generally, or of specific thereof, with colored or uncolored synthetic or natural organic inorganic reagents, or combinations of the two previous classes electron microscopic level we substitute differential electron changes for color.

This change in concept of the nature of staining has increased the scope of the book to include numbers of colored organic chromogenic reagents which combine with or as elements to produce color or altered electron density in them. The increase in the number of colored dyestuffs treated has at the class of reactive dyes appears in this book for the first time. We do not yet have much information on them. The 1973 hematoxylin has encouraged the quest for additional mordant dyes capable some of its commoner functions. As a further result of this we introduced among the natural dyes a small section on the an their sources and uses in histology, and a brief consideration chemistry. Additional tabular material on dye solubility has been

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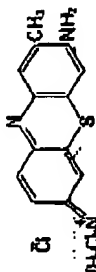
APPENDIX
D

of mast cells, cartilage and
Procedures, p. 129.

C.I. 52040

Classical name: Toluidine blue
syns: Methylene blue T 50 or T extra, Toloniumchloride,
Blutenechloride

is closely related to thionin and to methylene blue in structure,
more closely to azure A:



$C_{12}H_{12}N_4S_2Cl$; mol. wt. 305.832
(A basic dye; absorption maximum
620-622)

Solubility at 25°C: in water 3.82%;
in alcohol 0.57%; in ethylalcohol 3.5%;
in glycol 5.0%

toluidine blue was formerly furnished to biologists as the zinc chloride salt ($C_{12}H_{12}N_4S_2 \cdot 2ZnCl_2$), a fact clearly indicated by the dye of samples certified prior to 1955-1960 and the abrupt rise in dye t from 59 to 92% and 73 to 94% on successive samples from two manufacturers. Toluidine blue is now furnished in the zinc free

practice it proves difficult to distinguish this dye from azure A by photometric tests. This is particularly true because a shift in the absorption band of toluidine blue O sometimes occurs in storage as a result of the two dyes may become almost identical optically. Their great similarity is well brought out by comparing curve 1 (toluidine blue) and 2 (azure A) in Fig. 15.7 on p. 418. Ball and Jackson (1953) have shown by chromatography that toluidine blue O seems to be a mixture, and that this may account for much of the observed variation between

ough not a common textile dye, toluidine blue is more easily oxidized than thionin or azure A—a fact of considerable importance, since dye procedures it may be substituted for one or the other of these dyes. be employed like azure A as a nuclear stain for sections of fixed tissue and may be substituted for thionin in staining frozen sections of tissue. It is a valuable general nuclear stain, being ordinarily used in 0.3-1% aqueous solutions. It is widely employed in stains for granules or chromophilic bodies and has been proposed in a great number of special procedures. Well known among the latter is Papanheim's

TABLE 15.7. Procedures in Which Toluidine Blue Is Used Recommended by the Commission

Name of Procedure	Page Reference to Staining Procedures
A counterstain in Märsch silver reticulum methods	69
Nissl stains with toluidine blue	87
Toluidine blue-azocin red 8 for whole embryos	139
For metachromatic materials	159
Metachromatic argyrophil islet cells	179
Gor resin imbedded plant tissue	207
Albert's stain for diphtheria organisms	281
Kinyoun's volutin stain	283
Dienes' stain for Mycoplasma	297
Kirby's vital stain for protozoa	304

panchrome stain (of which it is an important ingredient) and the Albert stain which is widely replacing methylene blue in the diagnosis of diphtheria. It has use as a chemical reagent in the standardization of heparin and as a histochemical reagent in determining deoxyribonucleic acid. Among the earlier blood stains was a very good sequence method, in which a stain in a mixture of eosin WG and orange G was followed by a nuclear stain with toluidine blue and alcohol differentiation (Dominici, 1902). Today, toluidine blue is usually the first choice, especially in Europe, for the metachromatic (red-purple) staining of mast cells, cartilage and certain acid mucins.

Wolman (1971) reports a rather simple toluidine blue stain for amyloid utilizing its resistance to isopropanol extraction and its red birefringence.

The dye is obsolescent as a textile dye; the 1971 Colour Index lists "No known maker." But several lots a year are offered for certification by the Biological Stain Commission from a number of sources.

The use of toluidine blue in vital staining of plant cell vacuoles, protoplasm and cell walls is discussed in Stadelmann and Kinzel's (1972) review. They reported more specifically that an 0.01% solution stains nonlignified cell walls vitally, orthochromatically below pH 3, metachromatically above. The staining is assigned to acidic pectins on the cellulose.

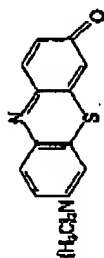
Blumenkrantz and Asboe-Hansen (1975) introduced a selective mast cell stain with toluidine blue in which the dye heparin complex is stabilized and insolubilized by use of a metachrome mixture of toluidine blue, ferric sulfate, and desferrioxamine B (Desferal - methane sulfonate of 30-amino-3,14,25 - trihydroxy - 3,9,14,20,25 - penta - azatriacanthane - 2,10,13,21,24 - pentanone).

References in Staining Procedures on Toluidine Blue are given in Table 15.7.

METHYLENE VIOLET (BERNHARDSEN)
(red)

C.I. 52041

Methylene violet is formed whenever methylene blue is heated with a fixed alkali or alkali carbonate. It is a weak base with the formula:



$C_{14}H_{12}N_4S$; mol. wt. 258.329
(Absorption maximum 579-581)

Bernthsen's methylene violet is soluble in alcohol, ether, and chloroform but insoluble in water. Its preparation from methylene blue is more difficult than that of azure A. A fair yield (30-40%) may be obtained by oxidizing methylene blue in dilute ammoniacal solution with potassium chromate and then driving off the ammonia by boiling with the addition of sodium carbonate. It may also be prepared from azure A by boiling this with dilute alkali carbonate. Methylene violet precipitates out as needle crystals, insoluble in water. It may be recrystallized from dichloroethane (CH_2Cl-CH_2Cl) in which it forms a deep carmine red solution. Although insoluble in water when pure, methylene violet is soluble when mixed with methylene blue or with the azures. It behaves much like a fat soluble dye and can be extracted from acid aqueous mixtures by shaking with chloroform or ether. It has a rather unusually shaped absorption curve, as shown in graph 3, Fig. 16.6 p. 417.

It plays an important part in the nuclear and granule staining of the polychrome methylene blue stains. A definite quantity of this dye is employed in the tetrachrome blood stain of MacNeal. It is thought to be responsible for the sky blue color assumed by the cytoplasm of lymphocytes in such blood stains.

Lillie (1944a) dissented from this opinion, considering the pure "robin's egg blue" lymphocyte cytoplasm staining assignable to azure B. It is, in fact, better shown in Giemsa than in Wright stain preparations, in the absence of methylene violet. Methylene violet is an effective participant in Romanovsky staining of blood films only in "on slide" staining in the presence of about 30% methanol. At higher dilutions it precipitates and tends to carry the eosinates down with it.

For formula and technic of MacNeal's Tetrachrome Stain, see *Staining Procedures*, p. 124.

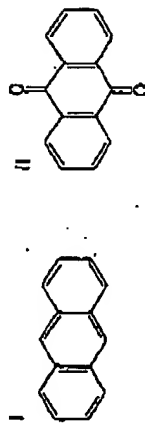
Methylene violet (Bernthsen, 1885) is not a textile dye and must not be confused with methylene violet RRA or 3RA, which is C.I. 50205 (basic violet-5).

16

Anthraquinone and Other Polycyclic Dyes, Indigoid Dyes

ANTHRAQUINONE GROUP

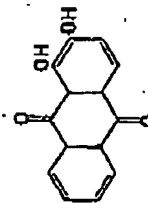
The anthraquinone dyes include derivatives of anthracene, (I) mol. wt. 178.238, through its oxidation product anthraquinone, $C_{14}H_{10}O_2$, mol. wt. 208.219



The chromogen anthraquinone is converted into a dye by the addition of hydroxyl groups, its best known derivatives among the dyestuffs being 2-dihydroxyanthraquinone (alizarin) and 1,2,4-trihydroxyanthraquinone (purpurin). Both of these compounds occur in nature in the roots of madder, being the colored principles of madder extract. They have the property of combining with metallic oxides to form so-called "lakes," compounds of different color from the dye entering into them. They are valuable dyes to use after mordanting with aluminum chromium compounds.

Hydroxyanthraquinones

ALIZARIN (CI 15700)
Various grades denoted as: Alizarin P, VI, Je
(C.I. Mordant Red 11)



$C_{14}H_8O_4$; mol. wt. 240.217

H. J. CONN'S Biological Stains

NINTH EDITION

*a handbook on the
nature and uses of the
dyes employed in
the biological laboratory*

R. D. LILLIE, M.D.

*prepared with the collaboration of various members
of the Biological Stain Commission*

Revised with the assistance of

**E. H. STOTZ, Ph.D. and
V. M. EMMEL, Ph.D., M.D.**

*Reprinted by Sigma Chemical Company
with Exclusive Permission 1990*



H. J. Conn

urtesy of the Archives of the American Society for Microbiology and Mrs. Jean Cochran.

PREFACE TO THE NINTH EDITION

As we reached the last month before press time for this edition to us of Dr. Conn's death on November 10, 1975. More than individual he was the founder of the Biological Stain Commission author of its major publications, *Stain Technology*, *Staining Protocols*, *History of Staining*, and, not least, of this book. The last, *Historical Stains*, now entering on its ninth edition, stands monument to him. He carried it through seven successful editions which well reflected the great expansion in the uses of "Biological Stains" not only as colors for tissues, but as agents altering the growth of organisms, as redox and pH indicators in chemistry and biology. The text is scarcely altered from his last revision.

In this edition we have adopted a new concept, that staining to be regarded as a variety of dyeing using natural and synthetic organic reagents. In fact this was not true before, for many organic dyestuffs functioned in their usual uses as combinations of the dye and metallic salt applied before, with, or after the dye.

We now regard staining on the optical microscope level as the of colored reaction products of tissues generally, or of specific thereof, with colored or uncolored synthetic or natural organic inorganic reagents, or combinations of the two previous classes electron microscopic level we substitute differential electron changes for color.

This change in concept of the nature of staining has increased the scope of the book to include numbers of colored organic chromogenic reagents which combine with or elements to produce color or altered electron density in them. The increase in the number of colored dyestuffs treated has The class of reactive dyes appears in this book for the first time do not yet have much information on them. The 1978 hematoxylin has encouraged the quest for additional mordant dyes capable some of its commoner functions. As a further result of this introduced among the natural dyes, a small section on the and their sources and uses in histology, and a brief consideration chemistry. Additional table material on dye solubility has been

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TECHNICAL DATA SHEET**DESCRIPTION:**

A high performance Quinacridone pigment which exhibits an exceptionally transparent, strong, bright, yellowish red shade

PRODUCT CODE: 228-0022**TRADE NAME:** SUNFAST®
Red 19

Revised 04-26-2002

COLOUR INDEX:**AVAILABLE FORMS:**

Presscake	X Dry Color
Lumps	Dispersions
High Solids	Flush

C.I. NAME: Pigment
Violet 19
C.I. NUMBER: 73900**C.A.S. NUMBER:** 1047-16-1**PROPERTIES****PHYSICAL**

Oil Absorption	45
Surface Area	62 m ² /g

DENSITY

g/cc	1.49
lbs/gal	12.43
kg/liter	1.49

LIGHTFASTNESS (1-8 SCALE)

Fulltone	7-8
1-10 Tint	7
1-25 Tint	7

HEAT STABILITY: 260°C (500°F)**CHEMICAL (1-5 SCALE)**

Acid	5
Alkali	5
Ethyl Acetate	5
Ethyl Alcohol	5
Glycols	4
Lacquer Solvents	4
Methyl Ethyl Ketone	4
Mineral Spirits	5
Water	5
Xylene	5

"Although the data supplied above are believed to be correct, the data are presented without any representation or warranty concerning the suitability, performance or correctness of the product for a particular application or use. Significant variations can occur between test results and results obtained in actual use. We strongly advise that before purchase the buyer test the product in the specific intended application under conditions expected during use. Suggestions made by Sun Chemical Corporation are our opinion only and there is no warranty of the results to be obtained."

APPENDIX E

Sun Chemical Corporation

MATERIAL SAFETY DATA SHEET

Product: 228-0022
Page: 1
MSDS: 134 Version: 1
Issue Date: 01/01/02
Date: 01/01/02

1. SUBSTANCE/PREPARATION AND COMPANY IDENTIFICATION

PRODUCT CODE: 228-0022
CHEMICAL FAMILY: Quinacridone
PRODUCT DESCRIPTION: Sunfast® RED 19
PRODUCT NAME: QUINACRIDONE RED 19

COLOUR INDEX NAME: Pigment Violet 19
COLOUR INDEX NUMBER: 73900

USE DESCRIPTION

Synthetic organic pigments are found in most products that are colored, such as printing inks, paints, plastics, cosmetics, contact lenses, medical devices, crayons, textile fibers, and numerous other applications.

MANUFACTURER:
Sun Chemical Corporation
5020 Spring Grove Ave.
Cincinnati, OH 45232-1960
(513) 681-5950
1-800-343-2583

EMERGENCY TELEPHONE NUMBERS:
Transportation: (513) 681-5950 Ext. 249
Product Safety: (513) 681-5950 Ext. 323

2. COMPOSITION/INFORMATION ON INGREDIENTS

Quinacridone Violet 19

C.A.S.# 1047-16-1

This product is not considered to be a hazardous substance as defined under OSHA's Hazard Communication Standard (29 CFR 1910.1200).

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW:

CAUTION!

When involved in a fire or exposed to high temperatures for an extended period of time, organic pigments may smolder or burn evolving noxious fumes which can include oxides of nitrogen and carbon, or other toxic compounds.

Synthetic organic pigments are highly insoluble, chemically inert substances which present minimal physical hazards when handled under normal, recommended industrial hygiene procedures.

4. FIRST AID MEASURES

EYE CONTACT

Flush eyes thoroughly with large amounts of water for at least fifteen minutes. Get medical attention.

SKIN CONTACT

Wash skin with soap and water. Remove severely contaminated clothing and clean before reuse. Seek medical attention in the unlikely event that irritation occurs.

(Continued on Page: 2)

MATERIAL SAFETY DATA SHEET

Product: 228-0022
Page: 2
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4. FIRST AID MEASURES (Continued)**INHALATION**

Remove to fresh air. Get medical attention if breathing is difficult.

INGESTION

Do not give anything by mouth to an unconscious person. Do not induce vomiting. Get immediate medical attention.

5. FIRE FIGHTING MEASURES

Nonflammable organic pigment product.

Extinguishing Media

Carbon dioxide, dry chemical or foam recommended. Apply water spray to cool exposed closed containers.

Special Fire-Fighting Procedures

Self-contained breathing apparatus (SCBA) and full protective equipment recommended.

Unusual Fire and Explosion Hazards

Fire or excessive heat may produce hazardous decomposition products.

General Hazard

Improper handling of any finely divided organic pigment powder may lead to dust cloud formation which may be an explosion hazard.

FLAMMABILITY DATA

Flash Point:	Non-flammable material
Flammability Limits:	No data
Autoignition Temperature:	No data
Dust Cloud Ignition Temperature:	No data
Dust Layer Ignition Temperature:	No data

NFPA RATINGS

Health: 1

Flammability: 1

Reactivity: 0

HMIS RATINGS

Health: 1

Flammability: 1

Reactivity: 0

6. ACCIDENTAL RELEASE MEASURES**Small Spill**

For dry powder spills, inert materials such as sand may be added to control dusting prior to cleanup. Industrial grade vacuum sweepers are also recommended. Place spilled material into appropriate waste containers for disposal.

Large Spill

Contain spilled material immediately with an inert substance such as sand or earth. Use plastic or aluminum shovel to transfer diluted waste material into appropriate containers for disposal.

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Product: 228-0022
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Date: 01/01/02

MATERIAL SAFETY DATA SHEET

6. ACCIDENTAL RELEASE MEASURES (Continued)

Airborne organic pigment dust may be an explosion hazard. Secure possible sources of ignition and avoid dusting.

7. HANDLING AND STORAGE

Handling

Avoid employee exposure through the use of appropriate engineering controls and good industrial hygiene practices.

Storage

Store in a moderately cool, dry, well-ventilated area away from direct sources of heat. Empty containers may contain product residues and should be handled appropriately. Position containers so that any labelling information is visible.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

The use of local exhaust ventilation is recommended.

Personal Protection

NIOSH approved dust respirators are recommended when handling in areas of pigment dusting. Safety glasses are also recommended. Impervious clothing should be worn when gross contact is likely, such as when cleaning up spills of large amounts.

Exposure Limits

There are no ACGIH TLV's or OSHA PEL's established for this product.

The OSHA PEL for nuisance dust is 15 mg/m³ (total dust), and 5 mg/m³ (respirable dust) recommended. The recommended ACGIH TLV for nuisance dust is 10 mg/m³.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: Finely divided powder
COLOR: Violet/yellowish red
MELTING POINT: No data
SPECIFIC GRAVITY: 12.43 lbs/gal
SOLUBILITY: Insoluble
PERCENT VOLATILE: Negligible
VAPOR PRESSURE: Not applicable
BOILING POINT: No data
MOLECULAR FORMULA: C₂₀H₁₂N₂O₂
VOLATILE ORGANIC COMPOUNDS (VOC's): None

(Continued on Page: 4)

MATERIAL SAFETY DATA SHEET

Product: 228-0022
Page: 4
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Issue Date: 01/01/02
Date: 01/01/02

10. STABILITY AND REACTIVITY

GENERAL:

This product is a stable compound and hazardous polymerization will not occur.

INCOMPATIBILITY:

Avoid strong oxidizing agents such as peroxides, chlorates, perchlorates, nitrates, and permanganates. Oxidizing materials may vigorously evolve oxygen in large amounts.

HAZARDOUS DECOMPOSITION PRODUCTS:

When involved in a fire, burning organic pigments may evolve noxious gases which are toxic. These compounds may include carbon monoxide, carbon dioxide, nitrous oxides, or hydrogen chloride, depending on the pigment type.

11. TOXICOLOGICAL INFORMATION

GENERAL

. Based upon industry-wide experience over many years of manufacturing and published toxicological studies, organic pigments in general are considered to be practically non-toxic. This low order of toxicity is probably due to the fact that pigments are somewhat inert and insoluble substances.

. There are no established TLV's or PEL's for dry color organic pigments.

ACUTE (SHORT-TERM) TOXICITY

Organic pigments are considered to have very low acute toxicity ratings. Available data indicate that these materials are typically non-irritating.

CHRONIC (LONG-TERM) TOXICITY

Although there are few published chronic toxicity studies available for organic pigments, almost all data indicate these products present no mutagenic or carcinogenic risk to man.

MUTAGENICITY

Very few pigments have been reported to be mutagenic.

12. ECOLOGICAL INFORMATION

Organic pigments, in general, have not been evaluated for their ecotoxicity. However, the biodegradation of these colorants under aerobic conditions is expected to be poor and there is no evidence to suggest they create any significant ecological problems when released into the environment. Since organic colorants are generally insoluble compounds, they are believed to have minimal bioaccumulation and bioavailability characteristics.

(Continued on Page: 5)

MATERIAL SAFETY DATA SHEET

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Date: 01/01/02

13. DISPOSAL CONSIDERATIONSGeneral

This product must be disposed of in accordance with all applicable federal, state and local regulations.

Waste Management

- Incineration or landfilling are recommended disposal techniques. Contact the state or local environmental agency for specific rules.
- This product is not identified as a RCRA hazardous waste under 40 CFR 261, and is not regulated under CERCLA (Superfund).

14. TRANSPORT INFORMATION

D.O.T. SHIPPING NAME (49 CFR 172.101-102).....: Not regulated
D.O.T. HAZARD CLASS (49 CFR 172.101-102).....: None
D.O.T. LABEL.....: None
D.O.T. PLACARD.....: None
BILL OF LADING DESCRIPTION.....: Pigments NOI Dry
CERCLA SUBSTANCE (49 CFR).....: Not regulated
REPORTABLE QUANTITY (RQ).....: None

INTERNATIONAL

UN/NA NUMBER.....: Not regulated
IMDG/IACO CLASSIFICATION.....: Not regulated
IATA CLASSIFICATION.....: Not regulated

15. REGULATORY INFORMATIONOSHA Hazard Communication Standard Status

Dry Color pigments are generally not considered to be hazardous substances under OSHA's Federal Hazard Communication Standard 29 CFR 1910.1200.

Toxic Substances Control Act (TSCA) Status

All of the ingredients of this material have been reported to the U.S. EPA and are included in the TSCA chemical inventory.

CERCLA Reportable Quantity (RQ)

NONE (Not regulated)

SARA Title III

Section 302 (EHS).....: NONE
Section 311/312 (Acute).....: NONE
Section 313.....: Call for details

RCRA

Many dry colors are not regulated as hazardous wastes under RCRA. Contact Sun Chemical Corp. for specific product code information.

(Continued on Page: 6)

MATERIAL SAFETY DATA SHEET

Product: 228-0022

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15. REGULATORY INFORMATION (Continued)EINECS (European Economic Community)

All components of this product are on the EINECS list.

16. OTHER INFORMATION

For more information contact Product Safety at

SUN CHEMICAL CORPORATION
COLORS GROUP
PRODUCT SAFETY DEPARTMENT
(513) 681-5950 EXTENSION 323

MR. JAMES M. WENKER

The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. Sun Chemical Corporation assumes no responsibility for personal injury or property damage caused by the material. Users assume all risks associated with the use of the material.

(Last Page)

Sun Chemical Corporation

MATERIAL SAFETY DATA SHEET

Product: 228-0044

Page: 1

MSDS: 18 Version: 1

Issue Date: 01/01/02

Date: 01/01/02

1. SUBSTANCE/PREPARATION AND COMPANY IDENTIFICATION

PRODUCT CODE: 228-0044

COLOUR INDEX NAME: Pigment Violet 19

CHEMICAL FAMILY: Quinacridone

COLOUR INDEX NUMBER: 73900

PRODUCT DESCRIPTION: Sunfast® RED 19

PRODUCT NAME: QUINACRIDONE RED 19

USE DESCRIPTION

Synthetic organic pigments are found in most products that are colored, such as printing inks, paints, plastics, cosmetics, contact lenses, medical devices, crayons, textile fibers, and numerous other applications.

MANUFACTURER:

Sun Chemical Corporation

5020 Spring Grove Ave.

Cincinnati, OH 45232-1960

(513) 681-5950

1-800-343-2583

EMERGENCY TELEPHONE NUMBERS:

Transportation: (513) 681-5950 Ext. 249

Product Safety: (513) 681-5950 Ext. 323

2. COMPOSITION/INFORMATION ON INGREDIENTS

Quinacridone Violet 19

C.A.S.# 1047-16-1

This product is not considered to be a hazardous substance as defined under OSHA's Hazard Communication Standard (29 CFR 1910.1200).

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW:

CAUTION!

When involved in a fire or exposed to high temperatures for an extended period of time, organic pigments may smolder or burn evolving noxious fumes which can include oxides of nitrogen and carbon, or other toxic compounds.

4. FIRST AID MEASURES

EYE CONTACT

Flush eyes thoroughly with large amounts of water for at least fifteen minutes. Get medical attention.

SKIN CONTACT

Wash skin with soap and water. Remove severely contaminated clothing and clean before reuse. Seek medical attention in the unlikely event that irritation occurs.

INHALATION

Remove to fresh air. Get medical attention if breathing is difficult.

(Continued on Page: 2)

MATERIAL SAFETY DATA SHEET

Product: 228-0044
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Issue Date: 01/01/02
Date: 01/01/02

4. FIRST AID MEASURES (Continued)INGESTION

Do not give anything by mouth to an unconscious person. Do not induce vomiting. Get immediate medical attention.

5. FIRE FIGHTING MEASURES

Nonflammable organic pigment product.

Extinguishing Media

Carbon dioxide, dry chemical or foam recommended. Apply water spray to cool exposed closed containers.

Special Fire-Fighting Procedures

Self-contained breathing apparatus (SCBA) and full protective equipment recommended.

Unusual Fire and Explosion Hazards

Fire or excessive heat may produce hazardous decomposition products.

General Hazard

Improper handling of any finely divided organic pigment powder may lead to dust cloud formation which may be an explosion hazard.

FLAMMABILITY DATA

Flash Point:	Non-flammable material
Flammability Limits:	No data
Autoignition Temperature:	No data
Dust Cloud Ignition Temperature:	No data
Dust Layer Ignition Temperature:	No data

NFPA RATINGS

Health: 1

Flammability: 1

Reactivity: 0

HMIS RATINGS

Health: 1

Flammability: 1

Reactivity: 0

6. ACCIDENTAL RELEASE MEASURESSmall Spill

For dry powder spills, inert materials such as sand may be added to control dusting prior to cleanup. Industrial grade vacuum sweepers are also recommended. Place spilled material into appropriate waste containers for disposal.

Large Spill

Contain spilled material immediately with an inert substance such as sand or earth. Use plastic or aluminum shovel to transfer diluted waste material into appropriate containers for disposal.

Airborne organic pigment dust may be an explosion hazard. Secure possible sources of ignition and avoid dusting.

(Continued on Page: 3)

MATERIAL SAFETY DATA SHEET

Product: 228-0044
Page: 3
MSDS: 18 Version: 1
Issue Date: 01/01/02
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7. HANDLING AND STORAGE

Handling

Avoid employee exposure through the use of appropriate engineering controls and good industrial hygiene practices.

Storage

Store in a moderately cool, dry, well-ventilated area away from direct sources of heat. Empty containers may contain product residues and should be handled appropriately. Position containers so that any labelling information is visible.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

The use of local exhaust ventilation is recommended.

Personal Protection

NIOSH approved dust respirators are recommended when handling in areas of pigment dusting. Safety glasses are also recommended. Impervious clothing should be worn when gross contact is likely, such as when cleaning up spills of large amounts.

Exposure Limits

There are no ACGIH TLV's or OSHA PEL's established for this product.

The OSHA PEL for nuisance dust is 15 mg/m³ (total dust), and 5 mg/m³ (respirable dust) recommended. The recommended ACGIH TLV for nuisance dust is 10 mg/m³.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: Finely divided powder
COLOR: Violet/yellowish red
MELTING POINT: No data
SPECIFIC GRAVITY: 1.50
SOLUBILITY: Insoluble
PERCENT VOLATILE: Negligible
VAPOR PRESSURE: Not applicable
BOILING POINT: No data
MOLECULAR FORMULA: C₂₀H₁₂N₂O₂
VOLATILE ORGANIC COMPOUNDS (VOC's): None

(Continued on Page: 4)

MATERIAL SAFETY DATA SHEET

Product: 228-0044
Page: 4
MSDS: 18 Version: 1
Issue Date: 01/01/02
Date: 01/01/02

10. STABILITY AND REACTIVITYGENERAL:

This product is a stable compound and hazardous polymerization will not occur.

INCOMPATIBILITY:

Avoid strong oxidizing agents such as peroxides, chlorates, perchlorates, nitrates, and permanganates. Oxidizing materials may vigorously evolve oxygen in large amounts.

HAZARDOUS DECOMPOSITION PRODUCTS:

When involved in a fire, burning organic pigments may evolve noxious gases which are toxic. These compounds may include carbon monoxide, carbon dioxide, nitrous oxides, or hydrogen chloride, depending on the pigment type.

11. TOXICOLOGICAL INFORMATIONGENERAL

Based upon industry-wide experience over many years of manufacturing and published toxicological studies, organic pigments in general are considered to be practically non-toxic. This low order of toxicity is probably due to the fact that pigments are somewhat inert and insoluble substances.

There are no established TLV's or PEL's for this product.

ACUTE (SHORT-TERM) TOXICITY

This product has a reported acute oral LD₅₀ value of 5 gm/kg or greater in rats.

Pigment Violet 19 was not considered to be a sensitizer when evaluated in the guinea pig maximization test for contact sensitization.

CHRONIC (LONG-TERM) TOXICITY

No known published data available.

MUTAGENICITY

In vitro screening tests for mutagenicity had reported negative results in an Ames Salmonella culture with DMSO solutions or dispersions of commercial pigments.

12. ECOLOGICAL INFORMATION

This product has not been evaluated for its ecotoxicity. However, the biodegradation of organic colorants under aerobic conditions is expected to be poor and there is no evidence to suggest they create any significant ecological problems when released into the environment. Since organic pigments are generally insoluble compounds, they are believed to have minimal bioaccumulation and bioavailability characteristics.

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13. DISPOSAL CONSIDERATIONSGeneral

This product must be disposed of in accordance with all applicable federal, state and local regulations.

Waste Management

Incineration or landfilling are recommended disposal techniques. Contact the state or local environmental agency for specific rules.

This product is not identified as a RCRA hazardous waste under 40 CFR 261, and is not regulated under CERCLA (Superfund).

14. TRANSPORT INFORMATION

D.O.T. SHIPPING NAME (49 CFR 172.101-102).....: Not regulated
D.O.T. HAZARD CLASS (49 CFR 172.101-102).....: None
D.O.T. LABEL.....: None
D.O.T. PLACARD.....: None
BILL OF LADING DESCRIPTION.....: Pigments NOI Dry
CERCLA SUBSTANCE (49 CFR).....: Not regulated
REPORTABLE QUANTITY (RQ).....: None

INTERNATIONAL

UN/NA NUMBER.....: Not regulated
IMDG/IACO CLASSIFICATION.....: Not regulated
IATA CLASSIFICATION.....: Not regulated

15. REGULATORY INFORMATIONOSHA Hazard Communication Standard Status

This product is not considered to be a hazardous substance under OSHA's Federal Hazard Communication Standard 29 CFR 1910.1200.

Toxic Substances Control Act (TSCA) Status

All of the ingredients of this material have been reported to the U.S. EPA and are included in the TSCA chemical inventory.

CERCLA Reportable Quantity (RQ)

NONE (Not regulated)

SARA Title III

Section 302 (EHS).....: NONE
Section 311/312 (Acute).....: NONE
Section 313.....: NONE

RCRA

Not regulated as a hazardous waste under RCRA.

EINECS (European Economic Community)

All components of this product are on the EINECS list.

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15. REGULATORY INFORMATION (Continued)

EINECS No.: 213-879-2

California's Proposition 65 Regulated Substances

This product does not contain any known levels of substances regulated under PROP 65.

CONEG Status

This product is certified to be in full compliance with CONEG Model Legislation for packaging and packaging ink components.

16. OTHER INFORMATION

For more information contact Product Safety at

SUN CHEMICAL CORPORATION
COLORS GROUP
PRODUCT SAFETY DEPARTMENT
(513) 681-5950 EXTENSION 323

MR. JAMES M. WENKER

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